Technical Report 70-6

A Determination of Selected Costs of Flight and Synthetic Flight Training

by

Oran B. Jolley and Paul W. Caro, Jr.

HumRRO Division No. 6

AD

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Office, Chief of
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HUMAN RESOURCES RESEARCH ORGANIZATION

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HumRRO Division No. 6
Fort Rucker, Alabama
HUMAN RESOURCES RESEARCH ORGANIZATION

Technical Report 70-6
Work Unit ECHO
Sub-Unit III

The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development, and consultation. HumRRO's mission in work performed under contract with the Department of the Army is to conduct research in the fields of training, motivation, and leadership.

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FOREWORD

The overall objectives of Work Unit ECHO are to survey and evaluate current synthetic flight training in Army aviation; to determine experimentally the value of selected flight training devices; and to establish guidance for the development and effective utilization of flight training devices in present and future aviation training curricula. Activities directed toward these objectives were begun by HumRRO in Fiscal Year 1964 at Fort Rucker, Alabama.

In ECHO Sub-Unit I, a survey of synthetic flight training equipment and practices was conducted at the U.S. Army Aviation School and at aviation field units within the continental United States. In ECHO II, the training value of a device embodying the captive helicopter concept was evaluated.

In ECHO III, research was conducted to determine the training effectiveness of a synthetic training device in use at the Aviation School; the work is described in HumRRO Technical Report 68-14, *Evaluation of Synthetic Instrument Flight Training in the Officer/Warrant Officer Rotary Wing Aviator Course.* Additional research under Sub-Unit IV concerns optimum utilization of that particular device. The present Technical Report describes a study, conducted under ECHO III, of the costs of operating the training device, and compares such costs with the costs associated with the operation of the training aircraft itself. The research was performed and most of the report preparation completed while HumRRO was part of The George Washington University.

The cooperation of the U.S. Army Aviation Center and School, of Page Aircraft Maintenance, Inc., and of Ross Aviation, Inc., was an important factor in the conduct of the ECHO III costs study.

The ECHO research is being performed by HumRRO Division No. 6 (Aviation) at Fort Rucker, Alabama, where the Director is Dr. Wallace W. Prophet. Dr. Paul W. Caro, Jr. is the Work Unit Leader.

Military support for this study was provided by the U.S. Army Aviation Human Research Unit, Fort Rucker. LTC Berkeley D. More and LTC Edward B. Covington, III were Unit Chiefs during periods when data described in this study were collected. LTC Ralph V. Gonzales is the present Unit Chief.

HumRRO research for the Department of the Army is conducted under Contract DAHC 19-70-C-0012. Training, Motivation, and Leadership research is conducted under Army Project 2Q062107A712.

Meredith P. Crawford
President
Human Resources Research Organization

SUMMARY AND CONCLUSIONS

MILITARY PROBLEM

The use of synthetic flight training devices is widespread throughout military and commercial aviation. The basis for their acceptance is the assumption that appropriately designed and used synthetic trainers will result in increased training effectiveness and reduced training costs. Although the assumption probably is valid on a generalized basis, the Army often has not had readily available information that would allow optimizing the combination of flight and synthetic flight training for a specific training requirement.

In 1965, although it recognized the potential contribution of synthetic training, the U.S. Army Aviation School questioned the validity of the particular manner in which synthetic trainers were being used in its largest aviator training program. Studies were undertaken which would provide data to determine whether such equipment was being used efficiently in terms of both training effectiveness and cost.

RESEARCH PROBLEM

Two kinds of data were needed; the training effectiveness of the synthetic trainers in use had to be determined, and the costs associated with the conduct of flight and synthetic training had to be identified. Data related to both problems were developed by the Work Unit ECHO research staff. The value of the trainers with regard to training effectiveness had been reported previously.[1] The present report identifies costs associated differentially with the conduct of flight training and of synthetic flight training at the Aviation School during September 1966. The study is limited to these particular costs in keeping with its purpose of determining the relative costs of flight and synthetic flight training within the context of a specific training program during a specific time period.

APPROACH

The approach taken in this research was to compute the costs that could be attributed to the conduct of instrument training in the Officer/Warrant Officer Rotary Wing Aviator Course (O/WORWAC) separately for the flight and synthetic flight training portions of the course. Costs associated with other training activities which did not contribute differentially to flight and synthetic flight training, such as academic instruction, were excluded, as were indirect costs such as those associated with administration of the U.S. Army Aviation Center and higher commands. The report describes the sources for and treatment of data used in the study and the major assumptions made in the allocation of costs among the various factors discussed.

RESULTS

It was found that, for the factors considered, the hourly costs of O/WORWAC instrument flight training during September 1966 were approximately six times as great as the cost of synthetic flight training.

[1] Robert N. Isley, Paul W. Caro, Jr., and Oran B. Jolley, *Evaluation of Synthetic Instrument Flight Training in the Officer/Warrant Officer Rotary Wing Aviator Course*, HumRRO Technical Report 68-14, November 1968.

CONCLUSIONS

In the particular course under study, replacement of one hour of flight training with less than six hours of training in the synthetic trainer would result in an overall reduction in both the costs of training and the density of air traffic at the Aviation School. Replacement of one hour of training in the aircraft with approximately six hours of training in the synthetic trainer would result in a reduction in the density of air traffic at the same training cost. (Decision to replace some flight training with synthetic training would need to be based in part upon the premise that training accomplished in the device would be equivalent to that which otherwise would have been received in the aircraft. However, that premise was not supported by the previously reported study of the effectiveness of training received in the device.

While the primary value of the study reported here is the documentation of certain costs associated with instrument flight training during FY 1967, the analytic procedures described have other possible applications. These include the development of current and more general training cost data describing Army aviator training and the development of data needed in cost-effectiveness studies of other complex training systems.

Since any cost study must be conducted for a specific purpose, the relevance of the results of the present study to questions other than those addressed herein must be determined in each case by the agency concerned.

CONTENTS

A Determination of Selected Costs of Flight and Synthetic Flight Training

INTRODUCTION

Army training personnel for years have debated the benefits of training devices. The assumed benefits generally have fallen into two categories. First, it has been proposed that training effectiveness is increased (as measured in terms of skill development) through the use of training devices in appropriately designed training programs. Second, it has been proposed that the use of training devices reduces total training cost because, typically, they are less expensive to acquire and use than operational equipment.

While the general validity of these contentions has been accepted widely, questions continue to arise concerning their validity for specific situations. Contention that the use of a synthetic flight training device increases training effectiveness and reduces training costs, for example, assumes some optimum combination of inflight and synthetic flight training. Yet, seldom does a training organization have in hand the information that would allow optimizing the combination. More often, the amount of training device use in a particular training program is determined by tradition, by the amount of time available for device training, or by some ratio of available devices to the number of trainees in residence. The validity of arguments for the specific amount of device training provided in such courses usually becomes a philosophic rather than an empirical matter.

In 1965, although it recognized the potential contribution of synthetic training, the U.S. Army Aviation School questioned the validity of the particular manner in which training devices were being used in its largest aviator training program. Specifically, the School questioned whether the use of synthetic flight training devices in the instrument phase of the Officer/Warrant Officer Rotary Wing Aviator Course (O/WORWAC) was efficient in terms of the training value and the relative costs of inflight and synthetic flight training. Studies were undertaken by HumRRO Division No. 6 (Aviation) that were designed to provide the Aviation School with the data needed to answer the question.

The required data consisted of two parts. First, the training value of the synthetic flight training being conducted had to be determined. This determination was made during the first quarter of FY 1967. It consisted of the collection of data, in a controlled experimental situation, describing the enhancement of trainee flight performance that could be attributed to training received in the synthetic training program. The data from that research activity have been reported previously.[1]

The second part of the required data consisted of a determination of the costs associated with the conduct of flight and synthetic flight training. Significant factors in the cost of both the inflight and the synthetic training were identified. These cost data were collected from available sources at the U.S. Army Aviation Center, and they are reported in this study.

APPROACH

The approach taken in this research was to compute the costs that could be attributed to the operation of O/WORWAC instrument training separately for the flight

[1] Robert N. Isley, Paul W. Caro, Jr., and Oran B. Jolley. *Evaluation of Synthetic Instrument Flight Training in the Officer/Warrant Officer Rotary Wing Aviator Course*, HumRRO Technical Report 68-14, November 1968.

Table 1

Materials and Services Included in the Cost Study

1. Aircraft Trainer
2. Buildings and Facilities
   a. Depreciation
   b. Utilities
   c. Janitorial service
   d. Maintenance
3. Salaries: Training Personnel
4. Contract or Fee
5. Office Equipment
6. Aircraft Trainer Maintenance
   a. Personnel
   b. Maintenance equipment
   c. Spare parts
7. Trainee Transportation
   a. Equipment operation
   b. Drivers' wages
   c. Equipment depreciation
8. Flight Clothing and Equipment
9. Aircraft Petroleum, Oil, and Lubricants
10. Aircraft Refueling Services
11. Navigation Facilities
    a. Buildings
    b. Equipment and furnishings
    c. Controllers
    d. Transportation

Table 2

Depreciation Periods Used in the Cost Study

Items	Months
Permanent buildings and facilities	600
Temporary buildings and facilities	300
Passenger busses	144
Synthetic trainers	120-144[a]
Trainer modification kits	48-132[b]
Aircraft	120
Furniture and office equipment	120
Maintenance tools and vehicles	120
Navigation ground equipment	120
Light passenger vehicles	72
Flight clothing and equipment	24

[a]The number of months between the months the various trainers came into the Army inventory and their scheduled replacement dates.

[b]The number of months between the months they were incorporated into the trainers and the scheduled replacement dates for those trainers.

and for the synthetic flight training portions of the course. According to the initial plan, the period to be covered by this cost analysis was to correspond with the training effectiveness portion of the study (i.e., the first quarter of FY 1967). It was found, however, that this period was one of expansion in training at the Aviation School, and training costs were undergoing adjustment. Therefore, the last month of the quarter—September 1966—was selected as the period for detailed cost study.

Table 1 indicates the various materials and services that were included in these cost computations. The materials and services included are those that may be attributed differentially to flight and synthetic flight training. Indirect costs associated with the conduct of both flight and synthetic flight training in the instrument phase of the O/WORWAC are not included. For example, costs associated with the administration of the U.S. Army Aviation Center, the conduct of O/WORWAC academic instruction, and trainee salaries and allowances were omitted.[2] Had such indirect costs been included, the effect would have been to increase the total cost shown for training. It is believed that the purposes of this study were served without including such indirect costs, since the intention here is not that of reflecting the total cost to the Army of aviator training.

The detailed computations involved in the determination of the costs associated with each of the materials and services identified in Table 1 are summarized in Appendix A. This Appendix also identifies the sources of the data used in these computations.

[2] Other indirect costs associated with Aviation School flight training in the course under study here are identified in: G. Kollin, *Army Training Costs: Phase I. An Examination of Costs and Recording Practices at CONARC Service Schools*, Technical Paper RAC-TP-204, Research Analysis Corporation, McLean, Virginia, May 1966.

Although the U.S. Army does not depreciate its property for accounting purposes, that means of representing the cost of equipment and facilities was selected for the present calculations. The depreciation periods which were adopted (Table 2) were judged to be reasonable estimates of the useful life of the items included in the study. Straight-line depreciation schedules were used, and the depreciation periods ranged from 600 months for permanent buildings to 24 months for flight clothing and equipment. Salvage value in each case was assumed to be zero.

RESULTS AND DISCUSSION

The monthly costs associated with the conduct of flight training in the course under study are summarized in Table 3, and the corresponding costs associated with synthetic training are summarized in Table 4. These costs total $957,844.48 and $57,662.32, respectively.

During September 1966, trainees in the instrument phase of the O/WORWAC received 15,782 hours of instruction in the TH-13T aircraft and 5,967 hours of instruction in synthetic trainers. Thus, the costs per hour of flight and synthetic flight training

Table 3

Costs Associated With the Conduct of O/WORWAC Instrument Flight Training During September 1966

1. Aircraft Depreciation	$ 87,388.00
2. Buildings and Facilities	
a. Depreciation	5,000.99
b. Utilities	1,461.17
c. Janitorial services	312.84
d. Maintenance	1,563.66
3. Salaries: Training Personnel	327,998.38
4. Training Contractor Fee	10,116.84
5. Office Equipment	227.98
6. Aircraft Maintenance	
a. Personnel	291,460.65
b. Maintenance equipment	1,851.77
c. Spare parts	132,400.02
7. Transportation	
a. Equipment operation	1,478.82
b. Drivers' wages	1,293.44
c. Equipment depreciation	283.84
8. Flight Clothing and Equipment	2,485.78
9. Aircraft Petroleum, Oil, and Lubricants	56,786.55
10. Aircraft Refueling Services	11,128.20
11. Navigation Facilities	
a. Buildings	$ 619.95
b. Equipment and furnishings	10,179.36
c. Controllers	10,712.00
d. Transportation	3,094.24
Total	$957,844.48
Training hours: September 1966	15,782 hours
Cost per flying hour	$60.69

Table 4

Costs Associated With the Conduct of O/WORWAC Instrument Synthetic Flight Training During September 1966

1. Trainer Depreciation	$11,853.13
2. Buildings and Facilities	
a. Depreciation	454.87
b. Utilities	311.94
c. Janitorial services	301.21
d. Maintenance	216.27
3. Salaries: Training Personnel	41,002.17
4. Training Contractor Fee	724.18
5. Office Equipment	25.96
6. Trainer Maintenance	
a. Personnel	2,118.73
b. Maintenance equipment	16.81
c. Spare parts	132.51
7. Transportation	
a. Equipment operation	85.26
b. Drivers' wages	343.83
c. Equipment depreciation	75.45
Total	$57,662.32
Training hours: September 1966	5,967 hours
Cost per training hour	$ 9.66

of interest in this study were $60.69 and $9.66, respectively. The ratio of cost between flight and synthetic flight training at the time of this study was approximately 6:1, that is, the cost of one hour of flight training was equal to the cost of approximately six hours of training in the synthetic device.

Many factors must be considered when the relative merits of flight and synthetic flight training are weighed. Not the least of these are the density of air traffic at a training location, the number of aircraft and synthetic trainers available, and the requirement of Federal statutes that certain minimum amounts of actual flight training be provided military aviators. Relative cost of flight versus synthetic flight training is not always an overriding consideration—in fact, it may not be a consideration at all. One of the bases typically used to justify the inclusion of synthetic training in a training program, however, is the potential money to be saved by use of the less expensive-to-operate synthetic equipment.

In the course under study, replacing the requirement for one hour of training in the aircraft with less than six hours of training in the synthetic trainer would result in an overall reduction in both the costs associated with that course and the density of air traffic. Replacement of one hour of training in the aircraft with approximately six hours in the trainer would result in a reduction in the density of air traffic at Fort Rucker at the same training cost. Both of these hypothetical actions assume that the training accomplished in the device would be equivalent to that which otherwise would have been received in the aircraft.

Reference to the report of the determination of the training value of the devices used for O/WORWAC synthetic training[3] at the time of the present study indicates that the assumption of equivalent training is not valid in this particular case. That study failed to demonstrate any value, in terms of the measured student flight performance parameters, of the O/WORWAC synthetic training being conducted in September 1966. Therefore, the cost information reported here is of relatively little consequence in terms of a broad objective to determine a cost-efficient combination of flight and synthetic flight training for the course under study.

In order to illustrate the usefulness of cost information in making such a determination, however, it might be assumed that a transfer of training study had found that trainees who received 20 hours of synthetic training attained criterion performance in 50 hours of flight training, and that members of an experimental group who received no synthetic training required 55 hours of flight training to attain the same performance level. In this hypothetical example, a flight training savings equivalent to approximately five hours would have been realized by trainees who received 20 hours of synthetic training. The ratio of training value in this hypothetical example is approximately 4:1, that is, the training value of one hour of flight training is equal in value to approximately four hours' training in the synthetic device. Under these circumstances, the device training could be judged as cost-effective on the basis of direct training cost factors alone.

Table 5 was constructed using the actual cost information derived during this study and the hypothetical equivalence ratio of 4:1 for synthetic flight and flight training. It can be seen that the maximum cost of training required to attain the course objectives,

Table 5

Costs of Selected Combinations of Flight and Synthetic Flight Training in the Instrument Phase of O/WORWAC
(September 1966 data)

Combination of Training		Cost of Flight Training @ $60.69/hr	Cost of Synthetic Training @ $9.66/hr	Total
Flight Hours	Synthetic Hours			
40	60	$2,427.60	$579.60	$3,007.20
41	56	2,488.29	540.96	3,029.25
42	52	2,548.98	502.32	3,051.30
43	48	2,609.67	463.68	3,073.35
44	44	2,670.36	425.04	3,095.40
45	40	2,731.05	386.40	3,117.45
46	36	2,791.74	347.76	3,139.50
47	32	2,852.43	309.12	3,161.55
48	28	2,913.12	270.48	3,183.60
49	24	2,973.81	231.84	3,205.65
50	20	3,034.50	193.20	3,227.70
51	16	3,095.19	154.56	3,249.75
52	12	3,155.88	115.92	3,271.80
53	8	3,216.57	77.28	3,293.85
54	4	3,277.26	38.64	3,315.90
55	0	3,337.95	0.00	3,337.95

[3] HumRRO Technical Report 68-14, *op. cit.*

that is, the cost of conducting all of the training in flight, is equal to the cost of 55 hours of flight training, or $3,337.95. By substituting synthetic training for flight training at the 4:1 rate selected for illustrative purposes, the cost of attaining the course objectives can be reduced as indicated in Table 5. Had a more favorable training value ratio been selected, such as, 2:1 or 1:1, the cost reductions accompanying increased use of synthetic training would have been greater. The converse is true, of course, for less favorable training value ratios, such as 8:1.

It should be recognized that the costs cited in Table 5 are valid only for the single combination of 50 flight training hours and 20 synthetic training hours, since the costs cited per hour of training were computed using those specific amounts of each type of training. Some of the data which are included in these per-hour costs—such as aircraft petroleum, oil, and lubricants—are relatively independent of the amount of training involved, while other costs—such as pro rata shares of buildings and facilities—will vary to some extent as a function of the amount of training conducted.[4] In other words, the relationship between cost of flight or synthetic training and the number of hours such training is conducted is not truly linear. As the amount of flight and synthetic flight training departs from the 50:20 ratio under study here, the less precise are the total cost figures cited in Table 5 (or in similar tables, should other combinations of training be used).

The costs reported are based upon certain assumptions concerning the attribution of costs to flight training, to synthetic flight training, or to categories not under study here. The major assumptions underlying these costs are made explicit in Appendix A where the various computations are dicussed. Any agency with an interest in the results of this study will be particularly interested in reviewing the computations and associated assumptions and determining whether the latter made in this study are consistent with the agency's interests. In some cases, it will be desirable to recompute the costs using different assumptions about the attribution of training costs.

Some assumptions underlying this study are not made explicit in Appendix A, but it is believed that they will be apparent to agencies interested in recomputing the costs reported here. For example, the distribution of costs associated with the buildings and facilities at Shell Army Heliport assumes that all of these facilities were constructed in an optimum manner for the training presently being conducted there. Such is not actually the case, however, as Shell AHP was constructed initially as an Army Air Field where fixed wing training would be conducted. In the present study, the costs of facilities at Shell which may be of relatively little value for rotary wing training, such as fixed wing runways, are attributed to the training under study. For some cost analysis purposes, it may be desirable to treat such items in a different manner.

This study is of primary value as a documentation of certain costs associated with instrument flight training at the U.S. Army Aviation School during September 1966, since the purpose of the study was specific to that time period. There is other value of a more general nature to a report such as this, however: It provides basic data and assumptions regarding these data which will allow others to further analyze the costs associated with Army aviator training. By updating the costs cited herein and expanding the study to include other portions of the training program, trainee salaries, administrative overhead, and other costs, total costs associated with the conduct of the entire training program can be determined. The institution of procedures to systematically develop and update such data for all Aviation School training programs would be of

[4]The range within which costs will vary probably is narrow, since a significant increase in the amount of training conducted will require the construction of additional facilities, the employment of additional training and maintenance personnel, the acquisition of additional aircraft and synthetic trainers, etc.

considerable value to training administrative personnel in adjusting budget estimates to coincide with programed trainee input changes and changes in trainee program content and equipment.

An additional value of this report is that the study illustrates procedures which may be employed to identify costs attributable to various portions of a relatively complex training system. Because Army accounting practices typically categorize cost data according to budget items, such differential cost data normally are not available to training officers who may wish to undertake studies of the cost-effectiveness of specific training activities or portions of training programs. This study demonstrates that it is possible to identify the appropriate cost data for such purposes without regard to the budget category involved. It should be noted that the procedures illustrated here are readily generalizable to any training situation. They are in no way specific to Army aviation.

Any cost study must be conducted for a particular purpose. That purpose will determine what cost information is relevant and how various costs will be attributed among various categories of interest. Information contained in this study—particularly information about sources of data—will be of interest to anyone conducting a similar study or updating the information contained herein. The relevance of the results of this study to a particular question, however, must be determined in each case by the agency concerned.

APPENDIX

Appendix A

COMPUTATION NOTES

1. AIRCRAFT/TRAINER DEPRECIATION

a. Aircraft

The aircraft used for O/WORWAC tactical instrument training is the TH-13T. They were acquired by the Army at a cost of $62,420.00 each (source: Supply Division, Department of School Support, U.S. Army Aviation School).[1]

One hundred fifteen TH-13T aircraft were located at Shell Army Heliport (AHP), and an average of 101 of these were available for flight each day during September 1966. Thus, there were 1.14 aircraft in the fleet at Shell for each one available for flight. A daily average of 75 aircraft was used to support O/WORWAC training during this period. Thus, 75 x 1.14, or 86 aircraft were required at Shell in order for 75 to be available for O/WORWAC training.

At Hanchey AHP during the same period, 102 aircraft were assigned, and an average of 74 of these were available for training each day. Average daily usage of TH-13Ts for O/WORWAC training at Hanchey was 59. The aircraft assigned to aircraft available ratio was 1.38 to 1, and 82 aircraft (59 x 1.38) were required to be assigned at Hanchey in order for 59 to be available for O/WORWAC tactical instrument training.

The monthly depreciation of the TH-13Ts used for flight training in the course under study was computed as follows: [(82 + 86) x $62,420.00]/120 mos. = $87,388.00.

b. Synthetic trainers

There were 57 synthetic flight training devices in use for O/WORWAC training during September 1966: 51 1-CA-1s, two 2-B-3s, and four 2-B-3As. The acquisition costs of these devices were $25,000, $53,631,[2] and $48,575,[2] respectively (source: Supply Division, Department of School Support, USAAVNS).

The monthly depreciation[3] for these trainers was computed as follows:

1-CA-1:	(51 x $25,000)/144 mos. =	$8,854.17
2-B-3:	(2 x $53,631)/132 mos. =	812.59
2-B-3A:	(4 x $48,575)/120 mos. =	1,619.16
	Total	$11,285.92

The synthetic trainers used in the O/WORWAC have undergone various modifications since their acquisition by the Army. The purposes of these modifications were to

[1] The sources of cost and other data included in this Appendix will be indicated as illustrated here.

[2] The construction of a 2-B-3 or a 2-B-3A makes use of a 1-CA-1. Therefore, the figure cited includes the cost of acquiring the 1-CA-1.

[3] The 1-CA-1s, 2-B-3s, and 2-B-3As were acquired by the Army in 1958, 1959, and 1960, respectively. At the time of this study, they were scheduled for replacement in 1970. The aircraft therefore were depreciated over periods equal to the difference between the year of acquisition and the year of scheduled replacement, or 144 months for the 1-CA-1, 132 months for the 2-B-3, and 120 months for the 2-B-3A.

incorporate radio-navigation equipment which had been added to Army aircraft and, in the case of the 1-CA-1, to convert them from a fixed wing to a quasi-rotary wing trainer configuration. Four such modifications have been made, and they are identified in Table A-1, which also indicates the dates each modification was accomplished, the trainer(s) involved, and the cost of modification material (sources: Maintenance Supervisor, Department of Rotary Wing Training, USAAVNS, and Office of the Aircraft Production Controller, Atlanta General Depot, Atlanta, Georgia).

The monthly depreciation[4] for the modification kits was computed as follows:

Kit ADF-MDF:	(51 x $ 17.82)/132 mos.	= $	6.88
Kit Omni Range:	(51 x $419.00)/132 mos.	=	161.89
Conversion:	(51 x $ 4.85)/60 mos.	=	4.12
RMI:	(57 x $332.06)/48 mos.	=	394.32
	Total		$567.21

The costs of the synthetic trainers attributable to the course under study are composed of their depreciated value plus the depreciated value of the incorporated modifications. These costs are $11,285.92 + $567.21 = $11,853.13 per month.

Table A-1

Trainer Modifications

Modification Identification	Date	Trainers	Cost
Installation of Kit ADF-MDF #6930-589-8035	1959	51 1-CA-1s	$ 17.82
Installation of Kit Omni Range #6930-573-1913	1959	51 1-CA-1s	419.00
Conversion to rotary wing configuration	1965	51 1-CA-1s	4.85
Installation of radio magnetic indicators (RMI)	1966	51 1-CA-1s 2 2-B-3s 4 2-B-3As	332.06

2. BUILDINGS AND FACILITIES

a. Depreciation

(1) Flight training

The buildings and facilities which are used in the conduct of O/WORWAC instrument flight training and in the maintenance of the training aircraft are tabulated in Tables A-2 and A-3. The costs of these buildings and facilities also are included in the tables (source: Real Property Section, Engineers Division, Deputy Chief of Staff for

[4]The modifications were depreciated over periods equal to the difference between the year of their application and the scheduled year of replacement for the trainer involved, i.e., 132 months for Kits ADF-MDF and Omni Range, 60 months for the rotary wing conversion, and 48 months for the RMI installation.

Table A-2

Buildings and Facilities Used for Flight Training and Aircraft Maintenance

Building Number	Description	Value
Shell AHP		
101	Fire Rescue building	$ 48,300.00
102	Airfield Operations building	140,000.00
103	Instructors' office and classrooms	205,700.00
104	Aircraft hangar	92,800.00
105	Aircraft hangar	92,800.00
106	Flammable material storage	1,600.00
117	Transmitter building (Radio)	16,200.00
118	Aircraft parts storage building	6,900.00
125	Aviation Operations building	16,000.00
126	Briefing building	17,500.00
130	General storehouse	300.00
N/A	Airfield pavement (hardstand)	551,000.00
N/A	Fuel storage	30,800.00
N/A	Navigation aid	800.00
N/A	Airfield lighting	151,800.00
N/A	Electrical distribution system	33,800.00
N/A	Gas pipe lines	3,100.00
N/A	Sewage: treatment, collection, disposal	15,600.00
N/A	Water distribution system	112,000.00
N/A	Roads	25,000.00
N/A	Walks	5,600.00
N/A	Ground drainage	214,200.00
N/A	Fencing	7,400.00
	Total	$1,789,200.00
Hanchey AHP		
101	Airfield operations	$ 155,200.00
102	Instructors' office and classrooms	214,200.00
106	GCA building	18,187.00
201	Maintenance hangar	455,565.00
202	Maintenance hangar	181,800.00
203	Aircraft parts storage	167,800.00
204	Maintenance hangar	175,500.00
205	POL storage	2,000.00
206[a]	Classrooms	804,975.97
207[a]	Maintenance hangar	
208[a]	Shop	
209[a]	Maintenance hangar	
210[a]	POL storage	

(Continued)

Table A-2 *(Continued)*

Buildings and Facilities Used for Flight Training and Aircraft Maintenance

Building Number	Description	Value
301	Refueling alert building	15,700.00
N/A	Control tower	11,200.00
N/A	Airfield pavement (hardstand)	2,288,000.00
N/A	Nav air/other	38,000.00
N/A	Airfield permanent lighting (includes vault)	159,400.00
N/A	Sanitary sewer	43,300.00
N/A	Ground drainage	315,700.00
N/A	Roads	74,800.00
N/A	Water distribution system	145,900.00
N/A	Sidewalks	3,300.00
N/A	Vehicle parking	29,200.00
N/A	Fencing	4,300.00
N/A	Steam distribution system	5,000.00
N/A	Electrical distribution system	109,607.00
	Total	$5,418,634.97

[a]Engineers Division of DCSLOG did not provide the value for these buildings individually but provided the cost of the building complex.

Table A-3

Buildings and Facilities on Main Post, Fort Rucker, Used for TH-13T Maintenance Management

Building Number	Description	Value
5302	Office building	$ 23,183.45
5303	Office building	23,183.45
5304	Office building	15,568.42
5305	Office building	3,375.00
5505	Office building	16,213.59
5506	Office building	36,064.95
5507	Office building	36,708.95
	Total	$154,297.81

Logistics, U.S. Army Aviation Center). The tabulations are by location, that is, Table A-2 contains the buildings and facilities located at Shell and Hanchey, and A-3 on the Fort Rucker Main Post.[5] Buildings and facilities associated with radar and radio beacon sites not located on the Fort Rucker Military Reservation are discussed in Section 11 of this Appendix.

These flight training buildings and facilities are used for eight rotary wing training courses in addition to O/WORWAC tactical instrument training. Consequently, their value must be prorated among these courses on an equitable basis in order that a pro rata share may be attributed to the training under study.

The size and complexity of a heliport usually is dependent upon the number of aircraft based there or upon the number of daily operations (take-offs and landings). Records of daily operations at Shell and Hanchey do not indicate the training course to which each could be assigned. It was not possible to take number of operations into account. The proration of buildings and facilities at Shell and Hanchey, therefore, is based entirely upon the number of aircraft assigned.

In addition to O/WORWAC, one other rotary wing flight training course was conducted at Shell AHP during September 1966. The TH-13T was used for O/WORWAC and the OH-13 was used for the other course. A total of 181 aircraft was assigned. Of these, 86 (see the above discussion of aircraft depreciation), or 48%, were used for O/WORWAC instrument training. Therefore, 48% of the value of the buildings and facilities at Shell AHP listed in Table A-2 was attributed to the course under study. All these facilities are classified as permanent construction, and they were depreciated over a period of 600 months. Their monthly depreciation was computed as follows: (.48 x $1,789,200.00)/600 mos. = $1,431.36.

Two hundred ten helicopters were based at Hanchey during September 1966. Of these, 102 were TH-13Ts, and 82 (see the above discussion of aircraft depreciation), or 39%, were used for O/WORWAC tactical instrument training. Therefore 39% of the value of the buildings and facilities at Hanchey AHP listed in Table A-2 was attributed to the course under study. They are all classified as permanent construction and were depreciated over a 600-month period. Their monthly depreciation was computed as follows: (.39 x $5,418,634.97)/600 mos. = $3,522.11.

The buildings listed in Table A-3 were used by a contractor who maintains all aircraft assigned to the Aviation School. They are of temporary construction and were used for housing management, administrative, and supply personnel. Approximately 12% of their management, administrative, and supply effort is directed to maintenance of the TH-13T fleet (source of time estimation: Manager, Page Aircraft Maintenance, Inc., Fort Rucker). Since 168 (77%) of the 217 assigned TH-13Ts are used in the O/WORWAC, 77% of the maintenance contractor's support of the TH-13Ts may be prorated to O/WORWAC tactical instrument training. The monthly depreciation of the value of the buildings contained in Table A-3, therefore, was computed as follows: (.12 x .77 x $154,297.81)/300 mos = $47.52.

Total monthly depreciation for buildings and facilities used to support O/WORWAC flight training is: $1,431.36 + $3,522.11 + $47.52 = $5,000.99.

[5] It is recognized that some of the facilities identified in Tables A-2 and A-3, such as roads and electrical systems, are necessary to the conduct of synthetic as well as flight training. The available records, however, do not allow the separation of a proportion of such facilities for attribution to each type of training, so they were attributed to flight training in this study. The effect of arbitrarily attributing all such shared facilities solely to flight training is to increase the apparent cost of flight training. The magnitude of the increase, of course, is a function of possible alternate assumptions, such as synthetic trainer building area as a proportion of the total area of buildings and facilities used exclusively in connection with flight training. A proportionate cost of these shared facilities on Main Post would be negligible and is not included in this study.

(2) Synthetic training

Synthetic flight training is conducted in three buildings: 6012, a temporary building located on the Main Post at Fort Rucker; 105, a permanent building located at Hanchey AHP; and 110, a permanent building located at Shell AHP. Two of these buildings, 6012 and 105, house synthetic trainers for courses other than O/WORWAC. The pro rata costs of these buildings attributable to the course under study were computed on the basis of the number of trainers in each which were used in the O/WORWAC as a percentage of the total number of trainers in each building. All the trainers located in Building 110 were used for O/WORWAC synthetic training during the period of this study.

Table A-4 shows the number of trainers in each of these buildings, the number and percentage of those trainers used in the course under study, and the cost of the buildings involved (source: Real Property Section, Engineering Division, DCSLOG, USAAVNC).

Office space for Fixed Wing Academic and Synthetic Branch instructor and management personnel was located in Building 6012. Office space for Rotary Wing Synthetic Training Branch management and maintenance personnel not engaged in the conduct of O/WORWAC training was located in Buildings 6012 and 105. For the purposes of this study, it was assumed that the percentage of such space occupied by instructor, management, and maintenance personnel not engaged in O/WORWAC synthetic training is not significantly different from the percentage of trainers used for O/WORWAC training which were housed in the two buildings. Therefore, depreciation for the buildings is based upon the percentages indicated in Table A-4.[6]

Table A-4

Distribution of Trainers by Building and Building Costs

Building Number	Total Trainers	Trainers Used in O/WORWAC	Percent Used in O/WORWAC	Building Cost
6012	52	21	40.4	$ 82,780.10
105	26	16	61.5	168,338.00
110	20	20	100.0	102,501.00

The amount of monthly building depreciation to be charged to the course under study was computed as follows:

Building 6012	(.404 x $ 82,780.10)/300 mos.	=	$111.48
Building 105	(.615 x $168,338.00)/600 mos.	=	172.55
Building 110	$102,501.00/600 mos.	=	170.84
Total monthly building depreciation			$454.87

[6] Had the costs of these buildings been based upon the proportions of personnel engaged in O/WORWAC training assigned to each instead of the proportion of trainers, 44.0% of the cost of Building 6012 and 59.7% of Building 105 would have been charged to the training under study instead of the figures cited in Table A-4. The total monthly building depreciation costs thus chargeable to O/WORWAC synthetic training would have been increased by $4.93.

b. Utilities

Utilities were computed on a Post-wide basis at $51.51 per year per person (other than students) working in a given building (source: Budget Analysis Section, Engineers Division, DCSLOG, USAAVNC).

(1) Flight training

The total number of flight personnel involved in O/WORWAC instrument flight training was 340.4.[7] Thus, ($51.51 x 340.4)/12 mos. = $1,461.17, the amount chargeable monthly to O/WORWAC flight training.

(2) Synthetic training

The total number of personnel involved in O/WORWAC synthetic training was 72.67.[8] Thus, ($51.51 x 72.67)/12 mos. = $311.94, the amount chargeable monthly to O/WORWAC synthetic training.

c. Janitorial service

Some janitorial service was performed by the maintenance and flight contractors, and the cost to the government was reflected in their contract cost. However, janitorial services for many classroom and office buildings were provided by a civilian contractor, and this cost must be included, where appropriate, in the overall cost of synthetic and actual flight training.

The janitorial service contractor provided two types of service. Cleaning done after duty hours by a cleaning crew at a cost of $.015 per square foot of "cleanable area"[9] per month, and janitorial service providing full-time janitors for larger buildings at a cost of $270.00 per month. (Source: Personal Property Supply Section, Engineers Division, DCSLOG, USAAVNC.)

(1) Flight training

Janitorial services were provided for only six of the buildings used in connection with flight training: Buildings 102, 103, and 126 at Shell and Buildings 101, 102, and 206 at Hanchey. Each of these buildings was serviced after duty hours by a cleaning crew, rather than by a full-time janitor. The amount of cleanable area for each building is indicated in Table A-5.

Table A-5

Cleanable Area of Buildings Used for Flight Training

Buildings at Shell AHP	Cleanable Area	Buildings at Hanchey AHP	Cleanable Area
102	4,866 sq. ft.	101	2,537 sq. ft.
103	11,988 sq. ft.	102	14,650 sq. ft.
126	3,818 sq. ft.	206	10,847 sq. ft.
Total	20,672 sq. ft.	Total	28,034 sq. ft.

[7] See Table A-9.
[8] See Table A-10.
[9] "Cleanable area" is defined as the inside dimensions of a building, minus boiler room area.

b. Utilities

Utilities were computed on a Post-wide basis at $51.51 per year per person (other than students) working in a given building (source: Budget Analysis Section, Engineers Division, DCSLOG, USAAVNC).

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The total number of flight personnel involved in O/WORWAC instrument flight training was 340.4.[7] Thus, ($51.51 x 340.4)/12 mos. = $1,461.17, the amount chargeable monthly to O/WORWAC flight training.

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Total	20,672 sq. ft.	Total	28,034 sq. ft.

[7] See Table A-9.
[8] See Table A-10.
[9] "Cleanable area" is defined as the inside dimensions of a building, minus boiler room area.

In order to determine the proportion of the costs of janitorial services for these six buildings that could be attributed to O/WORWAC flight training, the same procedure used to prorate the costs of the buildings themselves was employed, that is, proration was according to the proportion of aircraft based at Shell and Hanchey which were engaged in O/WORWAC tactical instrument training. Thus, 48% of the cost of janitorial services at Shell and 39% at Hanchey were attributed to flight training in this study.

The formula used to determine the costs of janitorial services was: cleanable area x monthly rate x percent of aircraft used, or (20,672 sq. ft.) ($.015) (.48) = $148.84 for Shell; and (28,034 sq. ft.) ($.015) (.39) = $164.00 for Hanchey. The total monthly cost of janitorial services attributable to the instrument flight training portion of the course under study was $312.84.

(2) Synthetic training

Each of the three synthetic training buildings, 110 at Shell, 105 at Hanchey, and 6012 on Main Post, was serviced after duty hours by cleaning crews. In addition, a full-time janitor devoted one-third of his time to cleaning Building 6012. Costs of these services were prorated to O/WORWAC synthetic trainers in a manner corresponding to that employed in the proration of flight training costs, except that the proportion of O/WORWAC-employed trainers in each building was used instead of the number of aircraft assigned. The cleanable area of Buildings 110, 105, and 6012 is 4,718 sq. ft., 9,368 sq. ft., and 17,765 sq. ft., respectively.

The cost of these services is computed below. In the case of Building 6012, $90, or one-third of the cost of a full-time janitor, was added to the computation as indicated.

Building 110:	(4,718 sq. ft.) ($.015)	= $ 70.77
Building 105:	(9,368 sq. ft.) ($.015) (.615)	= 86.19
Building 6012:	(17,765 sq. ft.) ($.015) (.404) + ($90) (.404)	= 144.02
	Total	$300.98/mo.

d. Maintenance

The Post Engineer is responsible for maintenance of buildings and facilities at Fort Rucker. Maintenance records do not associate costs with specific buildings, portions of installations, or utilities, but reflect, on a Post-wide basis, the costs of maintaining categories of facilities such as permanent buildings, roads, water systems, and land.

Table A-6 identifies each of the Fort Rucker building and facility categories and the cost of its maintenance during FY 1967. These costs are expressed in terms of costs per unit of size, that is, area or linear distance, as appropriate. The data in the table were derived by dividing the total area (or length) of all Fort Rucker buildings or facilities within each category into the total amount of money spent for the maintenance of each (source of cost and size data: Budget and Reports Section, Engineers Division, DCSLOG, USAAVNC).

(1) Flight training

For the purpose of prorating the costs of building and facility maintenance between flight and synthetic training, all maintenance—except that attributed directly to the maintenance of the synthetic trainer buildings at Shell (Building 110) and Hanchey (Building 105) AHPs—was arbitrarily attributed to flight training.

Table A-6

Categories of Buildings and Facilities and Their Annual Maintenance Costs Per Unit of Size

Category	Annual Cost per Unit
Buildings (permanent)	$133.11 per 1,000 sq. ft.
Buildings (temporary)	155.89 per 1,000 sq. ft.
Electrical system[a]	.014 per linear foot
Water system[a]	.0174 per linear foot
Gas distribution system[a]	.0289 per linear foot
Sanitary system[a]	.0109 per linear foot
Roads	22.81 per 1,000 sq. yds.
Walks and parking areas	19.96 per 1,000 sq. yds.
Runways and hardstand	13.74 per 1,000 sq. yds.
Land (upkeep)	11.83 per acre

[a]Maintenance of these systems from the point that they are tied into a building is included in building maintenance costs.

The buildings and facilities located at Shell and Hanchey, excluding the synthetic training buildings, are identified in Table A-2. The area of length of the buildings and facilities in each category is contained in Table A-7 for Shell and Hanchey AHPs. These tables also contain the annual cost of maintaining each category computed using the unit cost data presented in Table A-6.

The maintenance costs summarized in Table A-7 are attributable to all flight training conducted at the two heliports in question. As has been indicated above (see discussions of buildings and facilities depreciation), 48% of the buildings and facilities at Shell and 39% at Hanchey may be attributed specifically to O/WORWAC instrument flight training. Thus, the annual cost of building and facility maintenance attributable to the course under study is (.48) ($13,996.60) + (.39) ($30,885.88) = $18,763.86. The cost of this maintenance during September 1966, estimated at 1/12th the annual cost, was $1,563.66.

(2) Synthetic training

For the purposes of this study, only the costs of maintaining the three buildings in which synthetic training was conducted were considered attributable to synthetic training. These buildings have been identified earlier as 110 at Shell, 105 at Hanchey, and 6012 on the Main Post. Building 6012 is temporary, while the other two are considered permanent buildings. The area contained in these buildings is indicated for each in Table A-8. That table also contains the annual cost of maintaining these buildings, computed using the unit cost data contained in Table A-6.

The costs of maintaining these buildings were prorated on the basis of the number of trainers located in each which were used for O/WORWAC training (see discussion of buildings and facilities depreciation), that is, 100% of the maintenance costs for Building 110, 61.5% for Building 105, and 40.4% for Building 6012. Thus, the annual cost of maintaining the synthetic trainer buildings which was attributable to the course under study is $647.31 + (.615) ($1,299.55) + (.404) ($2,843.43) = $2,595.28. The cost of this maintenance during September 1966, estimated at 1/12th the annual cost, was $216.27.

Table A-7

Size of Flight Training Buildings and Facilities and Their Annual Maintenance Cost

Facility[a]	Size	Annual Maintenance Cost
Shell AHP		
Buildings (permanent)	51,137 sq. ft.	$ 6,806.85
Electrical system	68,908 linear ft.	964.71
Water system	2,559 linear ft.	44.53
Gas distribution system	2,083 linear ft.	60.20
Sanitary system	1,555 linear ft.	16.95
Roads	6,346 sq. yds.	144.75
Walks and parking areas	4,726 sq. yds.	94.33
Runways	215,000 sq. yds.	2,954.10
Land (upkeep)	246 acres	2,910.18
	Total	$13,996.60
Hanchey AHP		
Buildings (permanent)	146,237 sq. ft.	$19,465.61
Electrical system	84,789 linear ft.	1,187.05
Water system	27,017 linear ft.	470.10
Sanitary system	7,689 linear ft.	83.81
Roads	19,618 sq. yds.	447.49
Walks and parking areas	37,661 sq. yds.	751.71
Runways	544,000 sq. yds.	7,474.56
Land (upkeep)	85 acres	1,005.55
	Total	$30,885.88

[a]There is no gas distribution system at Hanchey AHP.

Table A-8

Size of Synthetic Training Buildings and Their Annual Maintenance Cost

Building Number	Size	Annual Maintenance Cost
6012	18,240 sq. ft.	$2,843.43
105	9,763 sq. ft.	1,299.55
110	4,863 sq. ft.	647.31

3. SALARIES AND ALLOWANCES OF TRAINING PERSONNEL

Figure A-1 is an abbreviated chart of the FY 1967 organization of the Department of Rotary Wing Training (DRWT) of the U.S. Army Aviation School and of the Rotary Wing Division of the civilian contractor engaged in O/WORWAC training. Personnel

Abbreviated Organization Chart for the Department of Rotary Wing Training and the Civilian Flight Training Contractor

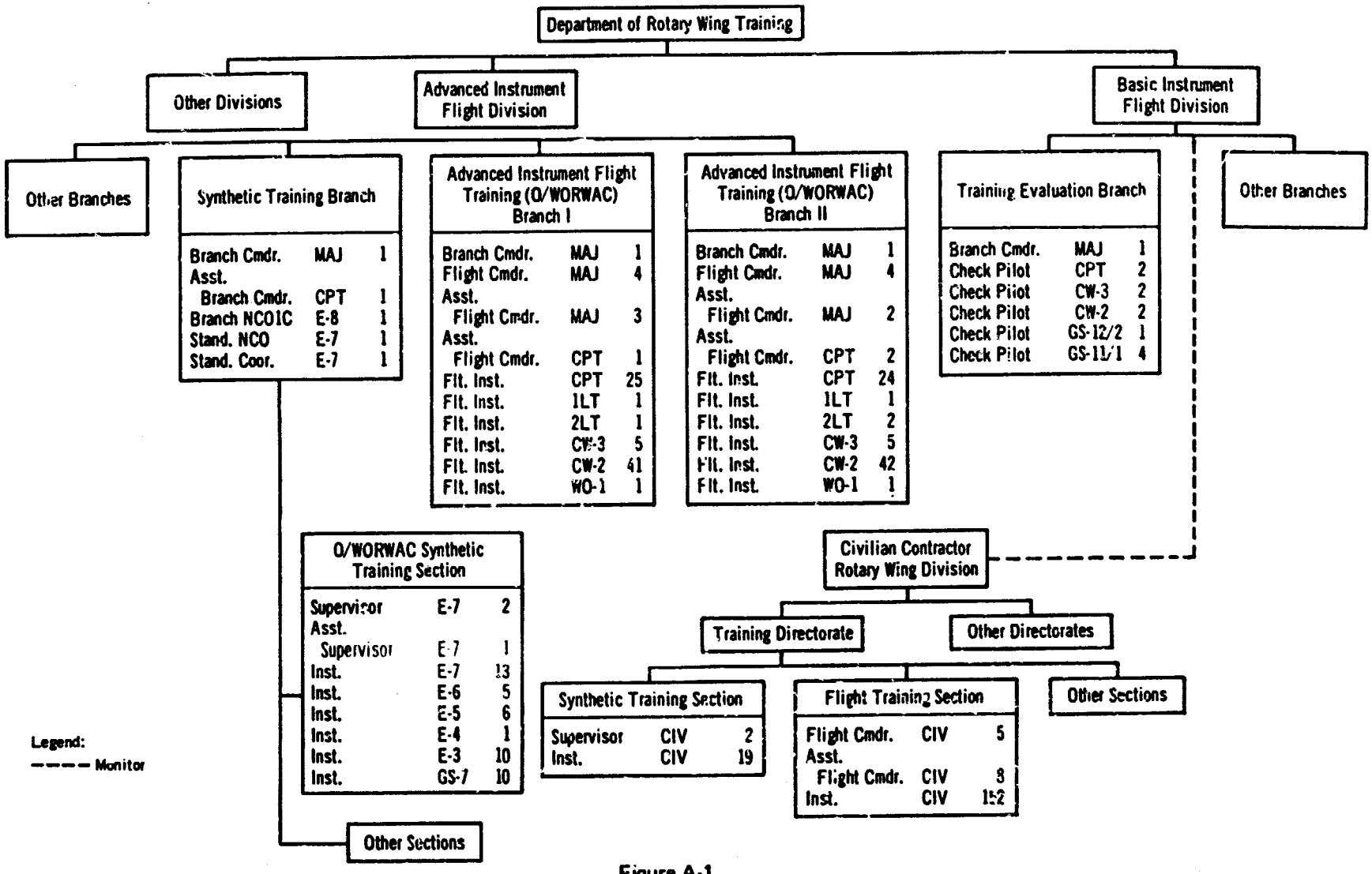

Figure A-1

engaged in the conduct of both flight and synthetic flight training for these two agencies are indicated on this chart.

In computing personnel costs for a study such as this, it is necessary to establish a point in the chain of command above which personnel will not be costed. For the present study, it was decided that personnel costs above Branch level for the Department of Rotary Wing Training and Section level for the civilian contractor would not be included. Personnel above these levels divide their time between flight and synthetic flight training. Training personnel whose duties were not directed primarily (at least half) to the effort being costed also were excluded from the present study, and such personnel are not included in Figure A-1.

a. Flight training

Personnel engaged in flight training in the O/WORWAC may be identified in Figure A-1 as being assigned to Advanced Instrument Flight Training Branches I and II of the DRWT and the Flight Training Section of the contractor's Rotary Wing Division. In addition, personnel assigned to the Training Evaluation Branch of DRWT devoted approximately 70% of their time to the administration of checkrides to trainees in the course under study (source of time estimate: Educational Advisor for Flight, Basic, Instrument Flight Division, DRWT). Thus, 332 persons were engaged full time and 12 were engaged 70% of the time in the conduct of O/WORWAC Tactical Instrument Phase flight training. These personnel are grouped by rank in Table A-9.

The costs of these personnel of interest in this study include all allowances and other direct costs in addition to salaries. In the case of military personnel, these costs include base pay plus incremental rates, allowance for quarters, retirement pay liability, subsistence allowance, uniform allowance, flight pay, death gratuities, and related benefits (source for data on pay and allowances for military personnel: AR 37-29, 21 September 1966).[10] In the case of Department of the Army civilian personnel, the government's contribution for retirement, insurance, health benefits, and FICA were included (sources for data on pay and allowances for DA civilians were DA Civilian Personnel Circular No. 9, 15 July 1966; and Civilian Pay Section, U.S. Army Aviation Center).

In the case of employees of the flight training contractor, the contractor's allowance for FICA, state and Federal employment insurance, and Workman's Compensation insurance are included (source for data on contractor employees: Office of the Executive Vice President of the contractor).[11] The costs of pay and allowances thus obtained are identified in Table A-9. The total monthly cost of the salaries and allowances of flight training personnel also is shown in Table A-9.

b. Synthetic training

Personnel engaged in O/WORWAC synthetic flight training may be identified in Figure A-1 as being assigned to the O/WORWAC Synthetic Training Section of the Synthetic Training Branch of the DRWT and to the Synthetic Training Section of the civilian contractor's Rotary Wing Division. In addition, the Standardization Coordinator

[10]The effective date of this regulation is 1 October 1966. However, par. 2-3, page 2-1, states in part: "Tables contained herein provide standard rates and composite rates to be used during FY 1967 in the Department of Defense for determining the cost of military personnel services as an element of operating cost." Since all costs computed in this study relate to the months of September 1966, rates contained in this regulation are considered appropriate for the present study.

[11] In addition to the pay and allowances paid to contract personnel, a contractor fee (profit) also is a direct cost associated with the provision by the contractor of flight and synthetic training personnel. The fee is treated in a separate section of this Appendix.

Table A-9

Flight Training Personnel Cost

Rank or Grade	Number Assigned	Monthly Standard Rate	Monthly Cost
Military			
MAJ	15.7	$1,381.00	$ 21,681.70
CPT	53.4	1,165.00	62,211.00
1LT	2	909.00	1,818.00
2LT	3	602.00	1,806.00
CW-3	11.4	1,075.00	12,255.00
CW-2	84.4	932.00	78,660.80
WO-1	2	798.00	1,596.00
D.A. Civilian			
GS-12/2	.7	1,011.63	708.14
GS-11/1	2.8	976.96	2,735.49
Contractor Employee			
Flt. Cmdr.	5	969.25	4,846.25
Asst. Flt. Cmdr.	8	944.25	7,554.00
Flt. Instr.	152	869.25	132,126.00
Total	340.4		$327,998.38

assigned to the Synthetic Training Branch, DRWT, engages on a full-time basis in coordinating the synthetic training program of the civilian contractor. Other personnel assigned to the Synthetic Training Branch devote approximately two-thirds of their time to the management of O/WORWAC synthetic training [12] and one-third to management of other synthetic training programs within the DRWT (source of time estimates: Commander, Synthetic Training Branch, DRWT). Thus, 70 persons were engaged full time and four two-thirds of the time in the conduct of O/WORWAC synthetic flight training. These personnel are indicated in Table A-10.

The costs of these personnel of interest in this study include the pay and allowances described in the above discussion of flight training personnel costs, and the sources of data on them are the same. The total monthly cost of the salaries and allowances of synthetic flight training personnel are indicated in Table A-10.

4. TRAINING CONTRACTOR FEE

The discussion in this Appendix of salaries and allowances of training personnel identifies certain personnel engaged in flight and synthetic training who are employed by a civilian contractor. The contractor is reimbursed by the Army for his direct costs, such as the salaries and allowances of his employees, and he receives a fee based upon such costs. The contract was governed, in part, by Section III, Revision No. 15, Armed Forces

[12] Personnel assigned to the Synthetic Trainer Maintenance Section, who are discussed in paragraph 6a(2) of this Appendix, also are supervised by the Synthetic Training Branch. The management of the O/WORWAC synthetic training activity is included in the two-thirds time reported here.

Table A-10

Synthetic Training Personnel Costs

Rank or Grade	Number Assigned	Monthly Standard Rate	Monthly Cost
Military			
MAJ	2/3	$1,381.00	$ 920.67
CPT	2/3	1,165.00	776.67
E-8	2/3	820 00	546.67
E-7	17 2/3	748.00	13,214.67
E-6	5	663.00	3,315.00
E-5	6	555.00	3,330.00
E-4	1	363.00	363.00
E-3	10	239.00	2,390.00
D.A. Civilian			
GS-7/1	10	580.00	5,800.00
Contractor Employee			
Supervisor	2	555.65	1,111.30
Instructor	19	486.01	9,234.19
Total	72 2/3		$41,002.17

Procurement Regulation, dated 1 February 1966. This regulation states that, for a contract such as is involved in this instance, the allowable fee varies from 5 to 9%. For the purposes of this study, the flight training contractor's fee was estimated at the mid-point of this range, or 7%.

a. Flight training

Reference to Table A-9 indicates that 165 contractor employees were engaged in flight training in the course under study. The monthly salaries and allowances paid these personnel total $144,526.25. Seven percent of this total is $10,116.84. This amount was the contractor's fee for the month of September 1966, attributable to flight training.

b. Synthetic training

Reference to Table A-10 indicates that 21 contractor employees were engaged in synthetic flight training in the course under study. The monthly salaries and allowances paid these personnel total $10,345.49. Seven percent of this total is $724.18. This amount was the contractor's fee for the month of September 1966, attributable to synthetic training.

5. OFFICE EQUIPMENT

All office equipment, including furniture, used by government and contractor personnel engaged in the conduct of O/WORWAC instrument flight and synthetic training was inventoried by cognizant USAAVNS or contractor representatives, and lists of these items were provided for use during this study[13] (sources of inventory data: Operations

[13] These lists are in the HumRRO Aviation Division library.

Section, Department of Rotary Wing Training, USAAVNS, and the training contractor's Property Custodian). Office equipment and furniture used by non-flight or synthetic training personnel are not included in this section of the Appendix. That used by maintenance personnel is treated as maintenance equipment for the purpose of this report and is discussed in paragraph 6 below. Similarly, that used by transportation personnel is discussed in paragraph 7.

a. Flight training

The office equipment used by the flight training contractor in the conduct of flight training was determined to have a value of $14,542.15 (source of all office equipment cost data: Supply Division, Department of School Support, USAAVNS). The value of the equipment used by military personnel conducting flight training was determined to be $12,298.07. Flight training personnel, assigned to the Training Evaluation Branch, who devote only 70% of their time to activities supporting O/WORWAC instrument training (see paragraph 3a) use office equipment valued at $739.30.

For the purposes of this study, all office equipment was depreciated over a 10-year period. Thus, the cost of office equipment attributable to the course under study during September 1966, was [$14,542.15 + 12,298.07 + (.70)$739.30]/120 = $227.98.

b. Synthetic training

Office equipment used in support of synthetic training in the course under study may be considered in three categories: that which is used exclusively by personnel who devote all of their time to O/WORWAC training; that used exclusively by personnel who engage in activities supporting O/WORWAC and other synthetic training; and that which is shared by O/WORWAC synthetic training as well as other personnel.

All of the cost of the office equipment used exclusively by personnel who support O/WORWAC training only is chargeable to that course. Since Building 110 at Shell was used exclusively for O/WORWAC training, all of the equipment located there is thus chargeable. The value of that equipment was $1,303.22.

Only a portion of the personnel who work in Building 105 at Hanchey are engaged exclusively in O/WORWAC training. The value of the equipment they use is $359.20. Branch management personnel, who devote only two-thirds of their time to O/WORWAC training (see paragraph 3b), use office equipment valued at $506.55. Furniture in the breakroom of Building 105 is shared by all personnel who work in that building. For the purposes of this study, the value of breakroom furniture, $133.75, was prorated to O/WORWAC training in proportion to the number of trainers in the building used for O/WORWAC, that is, 61.5% (see paragraph 2b).

The office equipment located in Building 6012 was treated in a similar manner. The value of the equipment used by personnel engaged exclusively in O/WORWAC training was $831.50. There were no management personnel located in Building 6012 who supervised O/WORWAC training (these personnel were located in Building 105). The value of breakroom furniture in that building was $498.80, and it was prorated on the basis of the percentage of trainers located there that were engaged in O/WORWAC training, that is, 40.4% (see paragraph 2b).

Thus, the cost of office equipment used in O/WORWAC synthetic training, depreciated over a 10-year period, was:

Building 110:	$1,303.22/120 mos.	=	$10.86
Building 105:	[$359.20 + 2/3($506.55) + .615 ($133.75)]/120 mos.	=	6.49
Building 6012:	[$831.50 + .404 ($498.80)]/ 120 mos.	=	8.61
	Total		$25.96

6. AIRCRAFT/TRAINER MAINTENANCE

a. Personnel

(1) Flight training

The TH-13T, along with other aircraft used for flight training at the Aviation School, is maintained by a civilian contractor who furnishes all labor and hand tools. For accounting purposes, maintenance contract costs, such as personnel and associated costs, are divided into organizational and field maintenance categories and are recorded separately for each aircraft type. For FY 1967, the costs of organizational and field maintenance for the TH-13T were $14.87 and $2.94, respectively, per flying hour (source: Comptroller, USAAVNC). These figures include all maintenance contractor personnel salaries and allowances, hand tools, and the contractor's profit. Thus, the contract aircraft maintenance costs for the month under study were determined by multiplying the monthly organizational and field maintenance costs of $17.81 per hour by 16,365,[14] the number of hours the TH-13T was flown during September 1966, in support of the course under study. The total cost for that month was $291,460.65.

(2) Synthetic training

Maintenance of the synthetic trainers used for O/WORWAC training during September 1966 was performed by one mechanic employed by the flight training contractor and six Army Wage Board employees assigned to the Synthetic Trainer Maintenance Section of the DRWT. The contractor's mechanic was engaged full time in the maintenance of the synthetic trainers operated by the contractor, while the Army employees maintained all synthetic trainers at Fort Rucker operated by the Army. One of these latter employees, grade of WL-12/3, estimated that he devoted five-eighths of his time to the supervision of O/WORWAC synthetic trainer maintenance. The other five, employed in the grade of WB-10/1, estimated that approximately one-half of their time was devoted to maintenance of O/WORWAC trainers.

The cost of the personnel of interest in this study includes all allowances and other direct costs in addition to wages. In the case of the contractor's mechanic, such costs include contractor's allowance for FICA, state and Federal employment and Workman's Compensation insurances (source: Office of the Executive Vice President of the contractor) and the contractor's fee (estimated at 7% as described in paragraph 4 of this Appendix). In the case of the Wage Board employees, the government's contribution for retirement, insurance, health benefits, and FICA were included (source: Army-Air Force Wage Board letter, subject, New Regular Wage Board Rate Schedules for the Dothan, Alabama, Locality, dated 20 September 1965; and Civilian Pay Section, USAAVNC).

The cost of synthetic trainer maintenance personnel attributable to the course under study during September 1966 was $2,115.55. The computation of this sum is shown in Table A-11.

b. Maintenance equipment

(1) Flight training

The Army furnished the maintenance contractor all required special tools, vehicles, furniture, and other equipment used in the maintenance of the training aircraft fleet. Neither the Army nor the contractor maintains records which indicate which items

[14] 15,782 flight training hours and 583 maintenance test flight hours.

Table A-11

Synthetic Trainer Maintenance Personnel Costs

Grade	Number Employed	Part of Time	Monthly Rate[a]	Monthly Cost
Contractor	1	Full	$573.99[b]	$ 573.99
WL-12 3	1	5 8	634.70	396.69
WB-10 1	5	1 2	459.22	1,148.05
		Total		$2,118.73

[a]Monthly rate includes all pay and allowances including employer's contribution to taxes and insurance.

[b]Includes a 7% estimate of the contractor's fee.

of such equipment are used in the maintenance of particular aircraft. Therefore, it was not possible to determine the exact value of government-furnished equipment used solely in the maintenance of the TH-13T.

At Shell AHP, however, only the TH-13T and the OH-13 are assigned. With the possible exception of a few special tools required to maintain the supercharger system of the TH-13T, these aircraft generally have a common equipment support requirement. Therefore, the maintenance equipment furnished the contractor for his use at Shell provided a basis for an estimate of the value of such equipment of interest in this study.

A list[15] was obtained of all such equipment and its cost (source: Contracting Officer for Aircraft Maintenance, DCSLOG, USAAVNC). The value of the items it contains is $234,973.23. In addition, three vehicles assigned to the Motor Pool at Fort Rucker are used by the contractor. They are a tractor, a trailer, and a gas tanker, and their total cost is $24,631.00. These vehicles are used to support Shell AHP maintenance activities approximately 18% of the time (source of cost data and utilization estimate: the maintenance contractor's Superintendent of Industrial Property and Inventory). Thus, the value of equipment used to support Shell AHP aircraft maintenance is $234,973.23 + $24,631.00(.18) = $239,406.81.

One hundred eighty-one aircraft were located at Shell during the period of this study. Thus, the cost of the maintenance equipment located there per aircraft was $239,406.81/181 = $1,322.69. This figure was used as a basis for estimating the value of government–furnished maintenance equipment required to support the 168 TH-13T aircraft located at Shell and Hanchey AHPs that were used in the conduct of O/WORWAC instrument flight training during September 1966. A depreciation period of 120 months was used, and the computation was ($1,322.69 x 168)/120 mos. = $1,851.77.

(2) Synthetic training

Equipment used to maintain the synthetic trainers in which O/WORWAC training was given was located in Building 105 at Hanchey AHP. An inventory[16] of this equipment was made and its value given as $2,153.40. In addition, an electrical tool kit, valued at $84.56, was located in Building 110 at Shell Field, and an electrical tool kit and a large vise, with a total value of $101.86, were located at Building 6012 on Main Post. These items were used exclusively for the maintenance of the synthetic trainers

[15]The list is in the HumRRO Division No. 6 (Aviation) library.

[16]The inventory list is in the HumRRO Division No. 6 (Aviation) library.

located in those two buildings which were employed in O/WORWAC training (source of synthetic trainer maintenance equipment cost data: Supply Division, Department of School Support, USAAVNS), and their costs may be attributed entirely to O/WORWAC training. The equipment located in Building 105, however, was also used to maintain synthetic trainers utilized in other rotary wing training courses.[17]

During September 1966, there were 67 synthetic trainers in use by the Department of Rotary Wing Training, of which 57, or 85%, were used in O/WORWAC instrument training. Thus, 85% of the cost of the maintenance equipment located in Building 105 may be attributed to the course under study. The costs of trainer maintenance equipment of interest in this study, depreciated over 120 months, were [($84.56 + $101.86) + (.85 x $2,153.40)]/120 mos. = $16.81.

c. Spare parts

(1) Flight training

Two separately funded categories of spare parts are used in the maintenance of Army aircraft: Operation and Maintenance, Army (OMA); and Procurement of Equipment and Missiles, Army (PEMA). OMA parts are relatively inexpensive items and are funded by the specific installation where they are used. PEMA parts are high-cost items such as engines, rotor blades, and transmissions, and they are funded by the U.S. Army Materiel Command.

During FY 1967, the monthly cost of OMA spare parts for the TH-13T was $6.52 per flying hour (source: Comptroller, USAAVNC). Since 16,365 hours were flown in that aircraft in support of O/WORWAC instrument flight training during September 1967, the cost of OMA-funded spare parts was $6.52 x 16,365, or $106,699.80.

Records of utilization of PEMA-funded spare parts indicate the cost of such parts for each aircraft per year rather than per flying hour. The costs of these parts used for the TH-13T during FY 1967 were $1,835.73 (source: Contracting Officer for Aircraft Maintenance, DCSLOG, USAAVNC). Since 168 TH-13T aircraft were required to support O/WORWAC instrument training [see paragraph 1a(1)], the monthly amount spent on PEMA spare parts during FY 1967 was (168 x $1,835.73)/12 = $25,700.22.

The cost of OMA- and PEMA-funded TH-13T spare parts of interest in this study, therefore, was $106,699.80 + $25,700.22 = $132,400.02.

(2) Synthetic training

All spare parts for the synthetic trainers at Fort Rucker are funded locally. During 11 months of FY 1967 (records for July 1966 were not available at the time data for this study were being collected) spare parts valued at $11,891.66 were used in connection with maintenance of the 47 training devices operated by DRWT. Records were not available of the parts used in the maintenance of the other 20 trainers operated by the training contractor.

In January 1967, 13 additional 1-CA-1 devices were acquired by the DRWT, and spare parts used to put them in operating condition and to accomplish the required modifications to them are included in the $11,891.66. In addition, further modifications were made to all of the 1-CA-1s operated by the DRWT during the period January to June 1967, and the costs of parts used in their modifications are included. The cited

[17]The equipment described in this section of the Appendix is used only in the maintenance of trainers used by the Department of Rotary Wing Training. Other equipment is used to provide maintenance support for trainers used by the Department of Advanced Fixed Wing Training.

figures, therefore, cannot be used as a basis for estimating the monthly cost of spare parts used to maintain the devices of interest in this study. As a consequence, spare parts used after 1 January 1967 were excluded from consideration.

During the five-month period August through December 1966, the value of spare parts used to repair the 21 rotary wing synthetic trainers in Building 6012 and the 26 trainers in Building 105 was $546.31. Using this total as a basis, the estimated value of parts used to maintain the 57 devices of interest in this study for one month was [($546.31/47)57]/5 = $132.51.

7. TRANSPORTATION

O/WORWAC trainees are billeted on the Fort Rucker Main Post and transported by bus to Shell and Hanchey AHPs for flight and synthetic training. The costs of this transportation of interest in the present study were those attributable to operation and depreciation of the buses and to the wages of the drivers involved.

a. Equipment operation

All transportation was scheduled to meet flight training requirements. Trainees received synthetic training at Shell and Hanchey on a schedule which would not interfere with their availability for flight training. No additional transportation was required for trainees who engaged in synthetic training at those two locations, and the cost of transporting trainees to and from Shell and Hanchey AHPs, with one exception, was attributed solely to flight training.

The exception concerns transportation which was provided trainees who received their synthetic training in Building 6012 on Main Post. Because of the limited facilities available at Hanchey, some trainees who were engaged in flight training there had to be transported from Hanchey to Building 6012 on the Main Post for their synthetic training. This was the only transportation expense attributed to synthetic training in this study.

(1) Flight training

Four buses were used to transport trainees to Shell AHP. Each bus made four 22-mile round trips daily—two to transport trainees from their assembly area on Main Post to Shell, and two to return them to their assembly area. The total distance traveled, therefore, was 4 buses x 4 round trips x 22 miles, or 352 miles per training day.

Five buses were used to transport trainees to Hanchey AHP. Four buses made two 10-mile round trips each morning—one to transport trainees to Hanchey and one to return them to their assembly area on Main Post. Three of these buses repeated these trips each afternoon. In addition, a fifth bus transported trainees to Hanchey at the beginning of each morning and afternoon and then provided transportation to Building 6012 for trainees receiving their synthetic training there. For the fifth bus, only the two 5 1/2-mile[18] trips each day to Hanchey were attributed to flight training. The total distance traveled, therefore, was (4 buses x 2 trips x 10 miles) + (3 buses x 2 trips x 10 miles) + (1 bus x 2 trips x 5 1/2 miles) = 151 miles per training day.

The cost of operating these buses was 14¢ per mile, a figure which included all maintenance, fuel, and a pro rata share of the motor pool's overhead (source: Motor Office, Transportation Motor Pool, DCSLOG, USAAVNC). Since there were 21 training days during September 1966, the cost of operating the buses used to transport trainees to Shell and Hanchey AHPs for flight training was 21(352 + 151) x $.14 = $1,478.82.

[18] The round trip to Hanchey was 5 1/2 miles in one direction and 4 1/2 in the other because it was necessary to pick up or drop off (but not both) trainees at their assembly point on each trip.

(2) Synthetic training

After transporting a load of trainees to Hanchey, one bus traveled an additional 14.5 miles each morning and afternoon transporting trainees between Hanchey and Building 6012 for synthetic training, for a total of 29 miles per day attributable to synthetic training. The cost of operating this bus during the 21 training days in September 1966 was 21 x 29 x $.14 = $85.26.

b. Drivers' wages

(1) Flight training

Except for the bus that was used to transport trainees to Building 6012, each of these buses was used for other purposes between trips to Shell or Hanchey AHPs. Each round trip to Shell, including waiting and turn-around time, consumed approximately one hour, and each such trip to Hanchey consumed approximately 40 minutes. Thus, the drivers of the four buses to Shell, who each made four trips each training day, devoted approximately four hours, or one-half of their work day, to the task.

Each of the four drivers of the buses to Hanchey devoted one hour and 20 minutes to their task each half day, or two hours and 40 minutes each for the three drivers who transported these trainees both morning and afternoon. The single driver who transported trainees to Hanchey once each half-day only devoted approximately 30 minutes to that task on each trip. Thus, the time devoted by three of the drivers was 40 minutes x 4 trips = 2 hours and 40 minutes, or one-third of their work day. The driver who transported trainees to and from Hanchey in the morning only devoted 40 minutes x 2 trips = 1 hour and 20 minutes, or one-sixth of his work day to the task. The remaining driver, who made only two 30-minute one-way trips, devoted one-eighth of his time to the task.

Average annual driver wages during the period of this study, including all pay and allowances, as described in paragraph 4 of this Appendix, were $4,715.32 (source: Civilian Pay Section, USAAVNS). Thus, the portion of the drivers' wages which may be attributed monthly to flight training costs is [4(1/2)$4,715.32 + 3(1/3)$4,715.32 + 1(1/6)$4,715.32 + 1(1/8)$4,715.32]/12 = $1,293.44.

(2) Synthetic training

The driver who devoted one-eighth of his work day to transporting trainees to Hanchey at the beginning of each morning and afternoon spent the remaining seven-eighths of each day transporting trainees to and from Building 6012 for synthetic training. Thus, the portion of his wages which may be attributed monthly to synthetic training costs is (7/8)($4,715.32)/12 = $343.83.

c. Equipment depreciation

Each of the buses used for trainee transportation was acquired by the Army at a cost of $12,417.00, and, for the purpose of this study, was depreciated over a 12-year (144-month) period. None of the buses were used exclusively in support of flight or synthetic training. Accordingly, it was necessary that their depreciation costs be prorated. The basis selected for this proration was the proportion of the work day that the buses were used in support of the course under study. These proportions are the same as were used above in prorating the drivers' wages.

(1) Flight training

The four buses used to transport trainees to Shell AHP were used for that purpose one-half of the time. Of the five buses used to transport trainees to Hanchey

AHP, three were used one-third of the time, one was used one-sixth of the time, and one was used only one-eighth of the time. Thus, the cost of the buses used to transport trainees to Shell and Hanchey AHPs for flight training was: [4(1/2)$12,417 + 3(1/3)$12,417 + 1(1/6)$12,417 + 1(1/8)$12,417]/144 = $283.84.

(2) Synthetic training

The single bus used to transport trainees between Hanchey AHP and Building 6012 for synthetic training was used for that purpose seven-eights of the time. The cost of that bus was (7/8 x $12,417)/144 = $75.45.

8. FLIGHT CLOTHING AND EQUIPMENT

Civilian personnel engaged in the conduct of flight training are issued the flight equipment and clothing listed in Table A-12. Military aviators are issued these same items, but, in addition, receive one pair of sunglasses, valued at $4.40, and one MB4 Computer, valued at $3.28. Since all military personnel are required to have boots, however, the boots issued to Army pilots are not categorized as flight clothing. The cost of flight clothing and equipment provided civilian pilots, therefore, is $183.30, while the cost of the clothing and equipment provided military pilots is $167.38 (source: Supply Division, Department of School Support, USAAVNS).

The number of military and civilian personnel engaged in flight training in the course under study, all of whom are pilots, is indicated in Table A-9 to be 171.9 military and 168.5 civilians. Using a depreciation period of 24 months, the monthly cost of the flight clothing and equipment chargeable to the Tactical Instrument Phase of the O/WORWAC was determined to be [(171.9)($167.38) + (168.5)($183.30)]/24 mos. = $2,485.78 monthly.

Table A-12

Flight Clothing and Equipment Issued to Civilian Pilots

Item	Number	Unit Cost	Total Cost
Flight helmet	1	$92.00	$ 92.00
Hood	1	16.20	16.20
Flight suit	2	16.80	33.60
Flight jacket	1	13.20	13.20
Flight gloves	1 pr.	4.70	4.70
Boots	2 pr.	11.80	23.60
	Total		$183.30

9. AIRCRAFT PETROLEUM, OIL, AND LUBRICANTS

The cost of petroleum, oil, and lubricants (POL) used in Army aircraft assigned to Fort Rucker is computed periodically by USAAVNC. For the period covered in this study, such costs were published in the Abbreviated Budget Execution Review for FY

1967 (source: Budget Division, ACS/Comptroller, USAAVNC). During FY 1967, the TH-13T POL costs were determined to be $3.47 per hour.

During September 1966, 16,365 hours of TH-13T flying time were logged in support of O/WORWAC instrument flight training. Therefore, the POL cost attributable to the course under study was 16,365 x $3.47, or $56,786.55.

10. AIRCRAFT REFUELING SERVICES

Aircraft refueling services at Fort Rucker are provided by a civilian contractor. The contract is similar to that held by the flight training contractor, except that the refueling contractor furnishes his own vehicles and equipment. According to the previously identified Abbreviated Budget Execution Review for 1967, the cost of the refueling contract was $0.68 per flying hour for the TH-13T, a figure which includes the contractor's fee. Since the TH-13T was flown 16,365 hours in support of O/WORWAC instrument training during September 1966, the cost of aircraft refueling services of interest in this study was $0.68 x 16,365, or $11,128.20.

11. NAVIGATION FACILITY

Instrument flight training requires that certain ground facilities associated with instrument navigation be available. In the case of O/WORWAC Tactical Instrument Training, these facilities consist of Ground Control Approach (GCA) radar and radio beacons for use in association with automatic direction finding equipment contained in the aircraft. Congestion of air traffic due to other training operations kept the radar and beacon facilities used by O/WORWAC trainees during September 1966 from being located on the Fort Rucker Military Reservation. The land upon which they were located had been leased by the government specifically for installation of the navigation equipment, and buildings to house that equipment had been constructed at each site. At the time of this study, there were four leased GCA sites and five ADF beacon sites used exclusively for O/WORWAC training.

a. Buildings

(1) Land Lease

The leased land upon which buildings housing GCA and radio beacon equipment were located are identified in Table A-13. The monthly lease cost of this land is indicated by site in the table. These costs total $140.08. (Source: Real Property Section, Engineering Divison, DCSLOG, USAAVNC.)

(2) Depreciation

Equipment at each GCA and beacon site is housed in buildings of temporary construction built for the purpose. Each GCA building is approximately 120 square feet in area. A wooden latrine, approximately 16 square feet in area, is located at each GCA site. Each radio beacon building is approximately 36 square feet in area. The construction cost of the temporary buildings located at each site is indicated in Table A-15. (Source of building cost and size data: Real Property Section, Engineering Division, DCSLOG, USAAVNC.) Thus, the monthly cost of the GCA and beacon site buildings depreciated over a 300-month period, was $8,113.64/300 = $27.05.

Table A-13

Land Lease and Other Costs for GCA and Radio Beacon Site Locations

Site Location	Site Type	Monthly Lease Cost	Building Construction Costs[a]	Site Size (Acres)	Average Monthly Power Cost
Blue Springs	Beacon	$ 15.00	$ 237.00	12	$ 6.79
Capps	GCA	2.08	1,692.66	30	52.41
Clopton	Beacon	12.50	237.00	12	8.40
Esto	GCA	37.58	1,692.66	21	77.95
Geneva	Beacon	8.33	266.00	10	9.33
Headland	GCA	22.92	1,742.66	22	88.50
Highway 27	Beacon	12.50	237.00	12	7.23
Skipperville	GCA	18.75	1,742.66	18	36.25
Webb	Beacon	10.42	266.00	10	9.64
Total		$140.08	$8,113.64	147	$296.50

[a]A commercial power company ran electrical connections from their source to each site building and maintained these lines as part of the service charged to utilities. The charge for the initial power installations is included in the building construction costs.

(3) Maintenance

As is the case with all Fort Rucker facilities maintenance (see section 2d and Table A-7), costs are not associated with specific facilities but are recorded on a post-wide basis. The cost of maintaining the navigation facilities, then, can be determined using the annual pro-rata cost information contained in Table A-7.

The only maintenance costs associated with the nine facilities under consideration at Fort Rucker are temporary building maintenance ($155.89 per 1,000 square feet annually) and land upkeep ($11.83 per acre annually). The four GCA buildings and their associated latrines total 544 square feet, and the five beacon buildings total 180 square feet, for a total temporary building area of 544 sq. ft. + 180 sq. ft. = 724 sq. ft. As indicated in Table A-13, the total area of the land upon which the nine sites are located is 147 acres. The monthly cost of maintaining these facilities is [(724)($.15589) + (147)($11.83)]/12 mos. = $154.32.

(4) Utilities

Electrical power is provided each site by a commercial power company. The average monthly (FY 1967) cost of the power provided each site is indicated in Table A-13. (Source: Repair and Utility Section, Engineers Division, DCSLOG, USAAVNC.) The total monthly utility cost for these nine navigation facilities was $296.50.

The total cost associated with the buildings which have the GCA and beacon equipment used for O/WORWAC tactical instrument training during September 1966 was $140.08 + $27.05 + $154.32 + $296.50 = $619.95.

b. Equipment and Furnishings

(1) Depreciation

Table A-14 indicates the equipment and furnishings located at the nine navigation facilities under consideration and the cost to the Army of each item. Except for the radio beacons and readic beacon antennae, each item is located at a GCA site. The radio

Table A-14

GCA and Beacon Site Equipment Costs

Item	Item Cost	Number of Items	Total
Transformer	$ 154.00	4	$ 616.00
FPN-40	82,500.00	4	330,000.00
AN/GRT-3	1,430.00	4	5,720.00
AN/GRR-7	425.00	4	1,700.00
Generator	1,549.00	4	6,196.00
Chair, folding	2.75	8	22.00
Chair, swivel w/arms	19.70	4	78.80
Table, field	11.90	4	47.60
Radio beacon, 25-watt, nondirectional	00.00	5	00.00
Antenna, radio beacon	150.00	5	750.00
Total			$345,130.40

beacons were obtained from the Federal Aviation Administration at no cost to the Army. The figures cited include initial installation costs. (Source: Navigation and Facilities Branch, A/COS Communications and Electronics, USAAVNC.)

The cost of the equipment listed in Table A-14, depreciated over a 120-month period, is $345,130.40/120 mos. = $2,876.09.

(2) Maintenance

During the period under consideration, the navigation equipment was maintained by five civilian employees, each of whom was provided an electronic repairman tool kit, TK-87. Each kit cost $70.00 (source: Supply Division, DOSS, USAAVNS), and was depreciated over a 120-month period. The five employees were in the pay grade of GS-7, Step 3, and each of them averaged $40.00 per month overtime during FY 1967 for a total monthly personnel cost, including all allowances and government contributions, of $656.07. (Source: DA Civilian Personnel Circular No. 9, 15 July 1966; and Civilian Pay Section, USAAVNC.) Thus, the monthly cost of maintaining the navigation equipment was (5)($70.00)/120 + (5)($656.07) = $3,283.27.

(3) Spare parts

In FY 1967, approximately $98,000 worth of spare parts were used to maintain all Army operated navigation equipment in the Fort Rucker area. Records do not indicate, however, the spare parts utilization associated with each navigation facility. Nevertheless, estimates of the value of spare parts used to maintain the equipment located at each GCA and beacon site were obtained. The estimates averaged $905.00 for each GCA site and $80.00 for each beacon site, per month, during FY 1967 (source of estimates: Chief, Navigation and Facilities Branch, A/COS Communications and Electronics, USAAVNC). Thus, the estimated cost of the spare parts required during the period under study was (4)($905) + (5)($80) = $4,020.00.

The cost associated with the equipment and furnishing located at each navigation facility during September 1966 was $2,876.09 + $4,282.27 + $4,020.00 = $10,179.36.

c. Controllers

Each of the four GCA sites was manned by three-man radar operator/controller crews. Due to the length of a duty day for these controllers, each site required two crews. Each crew worked every other duty day, but when night flying was scheduled, both crews worked the duty days. The senior shift supervisor also served as the site chief. No personnel are required on site to operate the radio beacon.

The assigned GCA controller strength during September 1966 totaled eight E-6s, whose monthly standard rate was $613.00, and 16 E-4s, whose monthly standard rate was $363.00 (source: AR 37-29, 21 September 1966). The total monthly cost of the GCA controllers was (8)($613) + (16)($363) = $10,712.00.

d. Transportation

(1) Equipment operations

The crew for each GCA site was provided a 3/4-ton passenger vehicle for transportation to and from the site. Crew members served as drivers. One round trip per duty day was made to each site except on those days when night flying was scheduled—then two round trips were made. Duty was scheduled for 21 days and eight nights during the month of September 1966. Therefore, 29 round trips were driven to each site during the month. The cost of operating these vehicles was 10 cents per mile, including all maintenance, fuel, and a pro-rata share of the motor pools' overhead (source: Motor Officer, Transportation Motor Pool, DCSLOG, USAAVNC).

Table A-15 shows the distances driven to and from each site by the GCA crews during September 1966. At 10 cents per mile, the crew transportation cost was ($.10)(252 miles)(29 days) = $730.80.

Table A-15

Vehicle Operation Mileage

Site	Mileage Round Trip
Capps	86
Esto	54
Headland	74
Skipperville	38
Total	252

Each of the five navigation equipment maintenance personnel also was provided a 3/4-ton passenger vehicle for transportation to the sites where maintenance was required. Each vehicle was driven an average of 200 miles per day during FY 1966 (source of estimate: Chief, Navigational Facilities Branch, A/COS Communications and Electronics, USAAVNC).

There were 21 duty days during the month of September 1966. Therefore, the cost chargeable to transportation for the five maintenance employees was: (5 men)(200 miles)(21 days)($.10) = $2,100.00.

(2) Equipment depreciation

The passenger vehicles were 1964 models which had been acquired by the Army at a cost of $1,803.00 each. Nine vehicles were required full time during the month: five for maintenance personnel and four for transportation of controllers to each GCA site. Four additional vehicles were required during the eight duty days that night flying was scheduled. Thus, 5 + 4 + (4)(8/21) = 10.52 vehicles, the number required altogether. Depreciated over a 72-month period, the cost of this equipment during September 1966 was (10.52 vehicles)($1,803)/72 mos. = $263.44.

The total transportation costs associated with operation of the nine navigation facilities during September 1966 were $730.80 + $2,100.00 + $262.44 = $3,094.24.

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13. ABSTRACT

As part of an analysis of the value of synthetic training at the U.S. Army Aviation School, costs associated with the conduct of flight and synthetic training in the instrument phase of the Army's Officer/Warrant Officer Rotary Wing Aviator Course were identified and computed separately for each type of training. It was found that, for the factors considered, the hourly cost of flight training at the time of this study (September 1966) was approximately six times as great as the corresponding cost of synthetic flight training. The report describes the sources for and the treatment of data, and the major assumptions made in allocating the costs. An illustration is provided of the usefulness of such cost information in determining a cost-effective combination of flight and synthetic flight training for attaining a particular training goal. Other applications of the reported information are discussed.

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